

United States Department of Agriculture
Grain Inspection, Packers and Stockyards Administration
Federal Grain Inspection Service

Program Handbook

July 7, 1995

FOREWORD

Book I, Grain Sampling, sets forth the policies and procedures for sampling grain in accordance with the regulations under the United States Grain Standards Act, as amended (Act).

The information contained in this handbook is applicable to official grain inspection services performed by the Federal Grain Inspection Service (FGIS), delegated State agencies, and designated State and private agencies. Persons interested in obtaining official services may call or write any FGIS field office or official agency.

Trade names are used solely to provide specific information. The mention of trade names does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

John B. Pitchford, Acting Deputy Director
Field Management Division

U.S. DEPARTMENT OF AGRICULTURE
Grain Inspection, Packers and Stockyards
Administration
Federal Grain Inspection Service
P.O. Box 96454
Washington, D.C. 20090-6454

GRAIN INSPECTION HANDBOOK
BOOK 1
7-07-95

TABLE OF CONTENTS

FOREWORD

CHAPTER 1 GENERAL INFORMATION

CHAPTER 2 PROBE SAMPLING

CHAPTER 3 SAMPLING WITH A DIVERTER-TYPE MECHANICAL SAMPLER

CHAPTER 4 ELLIS CUP AND PELICAN SAMPLING

APPENDIX 1 LOCAL QUALITY CONTROL PROCEDURES

U.S. DEPARTMENT OF AGRICULTURE
Grain Inspection, Packers and Stockyards
Administration
Federal Grain Inspection Service
P.O. Box 96454
Washington, D.C. 20090-6454

GRAIN INSPECTION HANDBOOK
BOOK 1
General Information
7-07-95

CHAPTER 1

GENERAL INFORMATION

1.1	DEFINITIONS	1-1
1.2	ABBREVIATIONS	1-2
1.3	SAFETY	1-2
1.4	REPRESENTATIVE SAMPLE.....	1-7
1.5	DETAILED WORK RECORD.....	1-8
1.6	ACCESSIBILITY	1-10
1.7	SAMPLE INTEGRITY.....	1-11
1.8	PROPORTIONAL SAMPLING.....	1-12
1.9	UNUSUAL CONDITIONS	1-14

1.1 DEFINITIONS

Carrier. A truck, trailer, truck/trailer combination, railcar, barge, ship, or other container used to transport bulk, sacked, or packaged grain.

Certification. The process of issuing an official certificate that indicates the quality of a lot or sample of grain or the results of some other official service.

Composite sample. A single sample composed of small portions taken from throughout a lot.

Lot. An identified amount of grain offered by an applicant for inspection.

Lot inspection. The process of obtaining a representative sample(s) of an identified grain lot, examining or testing the sample(s), examining relevant records of the lot, and certifying the results.

Official personnel. Any authorized Department employee or person licensed by FGIS to perform all or specified functions under the Act.

Official sample. A representative sample drawn by official personnel licensed or authorized by FGIS.

Sampling. The process of drawing a representative sample from a lot of grain.

Security container. A locked container in which official personnel store grain samples, supplies, and equipment.

Stowage examination. The process of visually determining if an identified carrier or container is clean; dry; free of live infestation, rodents, unknown substances, and foreign odor; suitable to store or carry grain; and certifying the results.

Submitted sample inspection. The process of grading or testing a sample of grain (other than an official sample) submitted by an applicant and certifying the results.

1.2 ABBREVIATIONS

The following abbreviations may be shown on work records.

ANFL	Animal Filth	DLQ	Distinctly Low Quality	SOUR	Sour
MOTHS	Angoumois Moths	GAR	Garlicky	SR	See Reverse
BRDX	Bird Excreta	HTG	Heating	SMUT	Smutty
BNS	Bottom Not Sampled	INF	Infested	FSUB	Unknown Foreign Substance
GLAS	Broken Glass	MUST	Musty		
CBUR	Cocklebur	RODX	Rodent Excreta		
COFO	Commercially Objectionable Foreign Odor				

1.3 SAFETY¹

- a. General. Comply with FGIS Directives 370.3, 370.4, and 370.5, and all pertinent Occupational Safety and Health Administration (OSHA) requirements; i.e., 29 CFR 1910 - 1918.
 - (1) Obey all posted warning signs and wear appropriate protective equipment when conditions warrant; e.g., ear protection when the noise level is high.
 - (2) When practical, carry a two-way radio for communication and use it in emergency situations.
- b. Life Vests. Wear a fastened, Stearns life vest, model IWV-222-1 (if not available, any U.S. Coast Guard-approved Type I, II, III, or V PFD life vests may be worn), when aboard barges or other vessels (midstream or dockside).

NOTE: Life vests must be international orange in color and contain retro- reflective panels. If used at night, the vest must be equipped with a light and whistle.

- c. Clothing.
 - (1) Hard hats must be worn that meet the American National Standards Institute (ANSI) Z89.1 or Z89.2 criteria.

¹ The safety requirements referenced in this section are mandatory for FGIS employees. Official agency employees are strongly encouraged to also follow them, as well as all OSHA regulations.

- (2) It is recommended that official personnel wear shoes or boots that have nonslip soles and definite heels for good footing on ladders.
- (3) Wear clothes that are reasonably close-fitting to reduce the possibility of becoming snagged on moving belts, ladders, or other equipment found in and around elevators and on carriers.
- (4) Gloves should be worn when climbing ladders and opening or closing hatches and doors.

d. Gangways and Ladders.

- (1) Check gangways before boarding. Do not use defective gangways.
- (2) Exercise extreme care when using ladders that are permanently affixed to carriers. Such ladders can become bent, broken, twisted, corroded, or have missing rungs. Do not use defective ladders.
- (3) Do not hand-carry sampling equipment, radios, or other equipment while climbing ladders.

e. Chemical Treatments. Remain alert to your physical condition, especially when drawing samples inside carriers. Grain is often treated with chemicals, usually for the purpose of controlling insect infestation. Contact with toxic fumes or sprays from these chemicals can cause serious injury or death. Shortness of breath, a headache, light-headedness, or drowsiness can be indicative of a dangerous atmosphere. When these symptoms are experienced, immediately leave the area and seek medical attention.

f. Transportation.

- (1) Travel to and from barges and ships anchored in midstream by a U.S. Coast Guard-approved launch, tugboat, or water taxi, or by an FAA-approved helicopter or air taxi.
- (2) Do not jump on or off a barge or ship. You must be able to step easily from the launch to the vessel without stretching or straining over water. Expect slippery or obstructed deck conditions when boarding a barge or ship.

g. Dock Areas.

- (1) Be alert for loose or rotting boards that may not support your weight when walking on a dock or wharf.
- (2) Learn the locations of life rings, emergency ladders, and telephones. Stay clear of all cables whether slack or under tension.
- (3) Watch out for tow-motors, cranes, cables, and debris.

h. Barges and Ships.

- (1) Do not probe sample barges at night unless the barge is docked and there is sufficient artificial light.
- (2) Use caution when walking on ship decks, barge tops, and ship gangways since they are uneven, slippery when wet, and have protruding cleats and latches. Stay clear of mooring ropes when they are being adjusted.
- (3) Do not remain on barges while they are being moved. Be aware of nearby barges, docks, or vessels which could collide with the vessel you are working on. Even a gentle bump can cause covers to roll.
- (4) Require the applicant to roll back the hatches and rolltop covers, and lock them in place with lock pins. Do not permit hatches to be opened or closed while you are inside the barge or ship.
- (5) Do not sample barges alone unless you are being monitored by someone who is in a position to render aid if needed. (That person may be an elevator employee or tugboat crew member.)

i. Railcars.

- (1) Before entering a railyard, notify your immediate supervisor, the yardmaster or switch-crew foreman, and any other essential persons of your presence. Also, inquire about possible switching activities, cars carrying hazardous cargo, and any other unusual activity. Do not sample railcars alone unless you are being monitored by someone who is in a position to render aid if needed. (That person may be an elevator employee.)
- (2) Before beginning sampling, see that all activity ceases on the track where you will be working:

GRAIN INSPECTION HANDBOOK

BOOK I

General Information

7-07-95

- (a) Require the track to be locked-out, or
 - (b) Require derails to be installed at both ends of the string of cars, or
 - (c) Follow other appropriate, locally-approved precautions; e.g., using blue flags with radio communication between official personnel and switch engine operator, using one or more additional employees as safety observers to warn-off approaching railcars, or using blue flags and a lock-out switch on an elevator hold-track where no railcar or switch engine movement takes place during the performance of official functions.
- (3) Do not probe sample railcars at night unless adequate artificial light is provided.
 - (4) Do not walk on rails. Always walk outside of tracks, never between.
 - (5) Ensure that no power lines are close enough to present an electrical hazard (minimum safe distance from power lines is 25 feet in all directions).
 - (6) Check for placarded railcars. If a railcar is not placarded but a fumigant odor is detected, withhold sampling (don't enter the car) and notify your supervisor immediately.
 - (7) Never crawl under, through, or over railcar couplings.
 - (8) Never walk through a break in a string of railcars separated by only a few feet (minimum safe distance - 20 feet).
 - (9) Always be alert to such hazards as moving railcars, cables, debris, metal strapping, and broken ladders.
 - (10) Be alert to seasonal conditions, such as icy or muddy walking surfaces, standing water, snow, and rain in the colder months; and rodents, snakes, insects, and other animals in the warmer months.

- (11) Always exercise caution when opening or closing hatches or doors. If a hatch or door is stuck open or closed, request assistance from the applicant.
- (12) If at all possible, do not use your hands to break seals. Use a cutting tool or pry bar.
- (13) Do not ride on a switch engine or a moving railcar. If inside a railcar and it starts to move, assume a sitting or kneeling position on top of or in the car to avoid losing your balance and hold on. Do not attempt to descend the ladder or jump to the ground until the car has stopped and you can do so safely. Report all such incidents to the yardmaster and your supervisor.
- (14) Before leaving the railyard, notify the yardmaster or switch-crew foreman, and any other essential persons that you are leaving the work area.
- (15) Report "bad order cars" (e.g., missing ladder rungs and broken doors) to the car owner, the railyard superintendent, or the applicant for inspection.

j. Trucks.

- (1) Do not walk through a break in a string of trucks separated by only a few feet.
- (2) Be alert to such hazards as moving trucks, cables, debris, metal strapping, or broken ladders.
- (3) Avoid breathing diesel exhaust fumes.

k. D/T Sampler Sites.

- (1) Watch out for dangerous accumulations of dust and grain spills.
- (2) Be familiar with elevator evacuation plans and follow the recommendation of the elevator manager if an evacuation is required.

1.4 REPRESENTATIVE SAMPLE





Obtaining a representative sample from a lot of grain is an important and essential part of the grain inspection process. If the sample is not representative, the inspector's final grade will not reflect the true grade of the lot. For a sample to be considered representative it must be:

- a. **Obtained by official personnel using official procedures and FGIS-approved equipment.**
 - (1) Official personnel include licensed samplers, technicians, and inspectors employed by official agencies and FGIS employees authorized to sample grain.
 - (2) Official procedures include FGIS directives, handbooks, and policy bulletins (e.g., Book I, Grain Sampling); and local FGIS field office/official agency policy memorandums
 - (3) See the FGIS Equipment Handbook for a complete list of approved equipment. Representative samples may be drawn from trucklots, carlots, and domestic movement bargelots by probe, pelican, Ellis cup, or diverter-type mechanical sampler. Except in an emergency, export shiplots and bargelots must be sampled by diverter-type mechanical sampler.
- b. **Of the prescribed size**--approximately 2,500 grams, but not less than 2,000 grams in size.
- c. **Handled securely, protected from manipulation, substitution, and careless handling.** Samples shall never be out of the sampler's control and/or observation and may lose their representativeness by being:
 - ⊗ Thrown or dropped from a railcar or other carrier;
 - ⊗ Spilled, no matter how little is lost or how much is recovered;
 - ⊗ Left unattended during the collection process;

- ⊗ Stored in an improper manner or in an area not under the control of official personnel. Store samples that are not graded on the same day they are obtained in approved, moisture-proof containers to prevent any change in condition; or
- ⊗ Transported by means which do not ensure the integrity of the sample. Official samples may be shipped via public transportation (e.g., commercial bus or air freight) **provided that** all necessary security precautions are taken, including--but not limited to-- enclosing the sample bag in a lock box or mail bag secured by a metal seal or lock.

1.5 DETAILED WORK RECORD

The accurate recording of the lot's identity and condition at the time of sampling is vital to the correct certification of the lot's quality. It is not unusual for a grade-determining condition, such as large stones, heating grain, or moths, to be readily apparent in the lot during sampling but not in the sample. Also, insects, debris, and unknown foreign substances may be found around hatch openings and under walkways of carriers. When such conditions are found, clearly note the condition--in detail--on the sample ticket or comparable work record. Sample tickets shall contain the following information:







-  Sampler's signature or initials.
-  Date the sample was obtained.
-  Location of the lot at the time of sampling, e.g., IC Yard. If the city and/or State are not obvious, this must also be shown.
-  Identification of the lot, including:
 - ◇ For trucklots, the truck's license plate number, with State abbreviation;

NOTE: Sometimes, a truck may return to an elevator more than once a day. To keep the trucklots separate, show additional identifiers, such as a contract numbers or the time each sample was taken.

- ◇ For truck-trailerlots, the trailer's license plate number (not the tractor's), with State abbreviation;

NOTE: Trucklots, truck-trailerlots, and similar lots may be identified by other identifiers provided the applicant agrees with the identifier used and the identifier permits clear identification of the lot.

- ◇ For railcar lots, the alphanumeric on the side of the car (make sure that the same identifier is shown on all sides of the car);
- ◇ For bargelots, the complete name and/or alphanumeric as shown on the barge; and
- ◇ For shiplots, the name of the vessel preceded by the abbreviation for it's means of propulsion; e.g., MV.

-  Type of carrier; e.g., truck, hopper car, or barge.
-  Type of movement; e.g., in, out, local, or export.
-  When applicable, the number and prefix of seals broken and applied.
-  Method of sampling.
-  When applicable, any information related to the condition of the carrier's stowage area.
-  Other pertinent information that may affect the grading or certification of the lot, such as the notation "Top ____ feet sampled. Bottom not sampled."

1.6 ACCESSIBILITY

To obtain a representative sample, the entire lot must be completely and safely accessible.

- a. Hazardous Conditions. When hazardous conditions exist which could endanger the health of the sampler, consider the lot inaccessible and dismiss the inspection request. Hazardous conditions include, but are not limited to:
 - The presence of insecticides, fumigants, or other chemical odors;
 - Uncontrolled railyard switching;
 - Electrical storms;
 - Ice on top of barges, railcars, and ships;
 - Broken or unsecured ladders; and
 - Low hanging electrical wires.
- b. Heavily Loaded. If a container is loaded in such a manner as to prevent drawing a sample according to established procedures, consider it to be "heavily loaded."
 - (1) Dismiss requests for sampling and inspection of "heavily loaded" out-bound movements of grain.
 - (2) "Heavily loaded" in-bound and local-movements of grain shall be sampled as accurately as possible, and the statement "Partial Inspection - Heavily Loaded" shown on the sample ticket with a description of the sampling method and location from which the samples were drawn.
- c. Entrances.
 - (1) Trucks. Consider grain in trucks to be inaccessible for sampling when tarps, coverings, or doors are not fully removed or opened.
 - (2) Other Carriers. Consider grain in other carriers to be inaccessible for sampling when hatches or doors cannot be opened.

1.7 SAMPLE INTEGRITY

- a. Often, when grain is sampled online by either mechanical or manual sampling devices, there is a break in the loading/unloading process and official personnel are dismissed. In such situations, if adequate security measures are not taken, grain could be loaded on top of the lot or removed from the lot during the sampler's absence. As a result, the sample would not be representative of the grain in the carrier and a false or incorrect certificate might be issued.
- b. Whenever there is a break in online sampling activities, take **all** necessary actions to ensure that no grain can be loaded into or unloaded from the carrier until you return to the work site and sampling activities resume.

NOTE: Official agency and/or FGIS field office managers are responsible for determining what precautions are needed at each facility.

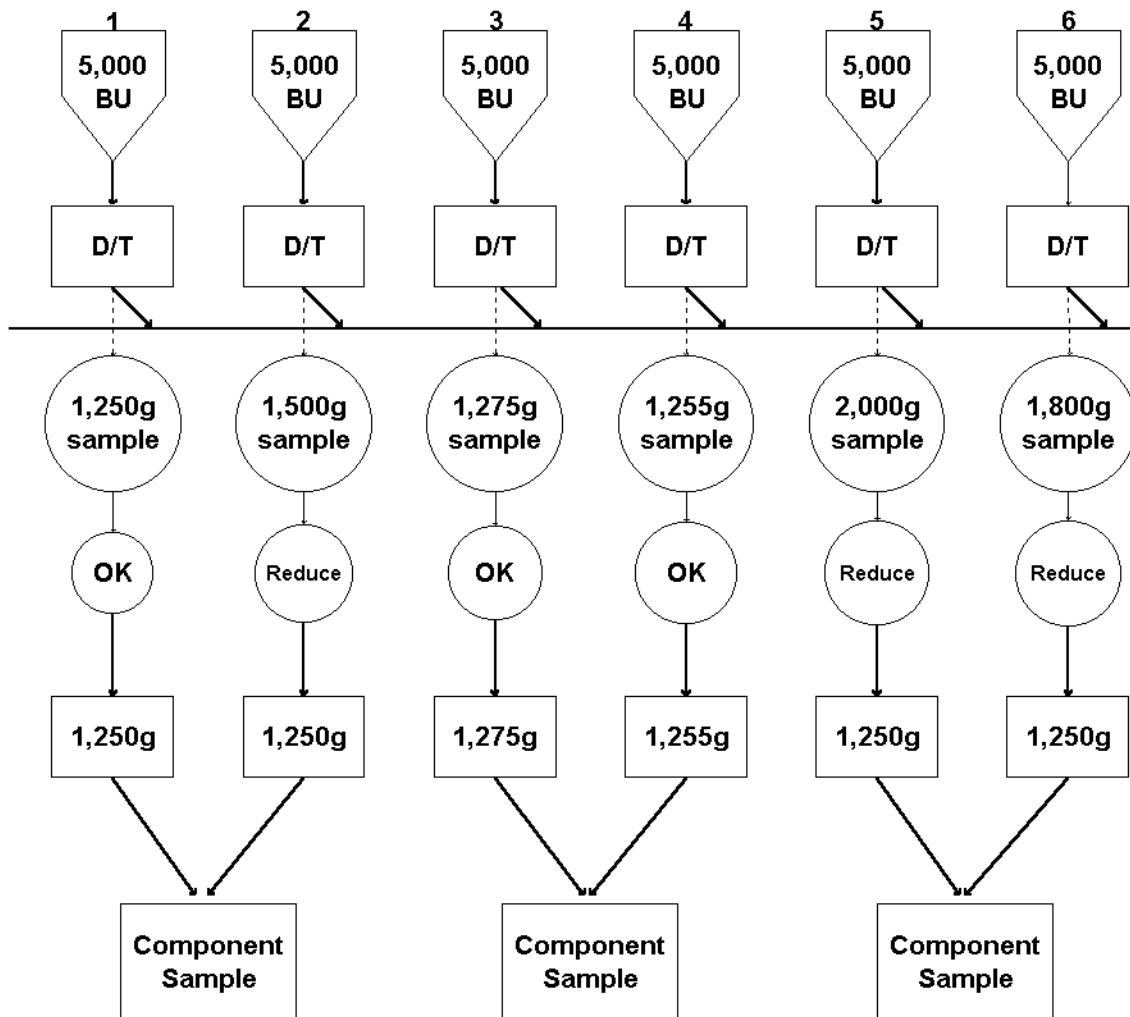
- c. Note on the sample ticket, or another comparable work record, what and when such precautions are taken. Appropriate precautions may include, but are not limited to:
 - ✓ Locking-out belt trippers and other elevator grain handling equipment.
 - ✓ Applying seals(s) to the carrier to deter and detect any carrier-related grain handling activity.
 - ✓ Physically monitoring the elevator and carrier.
 - ✓ Preparing notes and diagrams regarding the position of grain within the carrier, draft level, or other pertinent information to assist in determining if grain was added or removed.

NOTE: If you suspect that grain was loaded into or unloaded from a carrier during a break in sampling operations, notify your supervisor immediately in accordance with FGIS Program Directive 366.1, "Reporting Violations of the U.S. Grain Standards Act and the Agricultural Marketing Act of 1946," and FGIS Program Directive 907.5, "Deceptive Grain Handling Practices."

1.8 PROPORTIONAL SAMPLING

- a. Frequently, a sample drawn from one carrier or portion of a carrier is combined with another sample(s) to form a component, subplot, or combined-lot sample. Prior to combining such samples, the sampler must ensure that the samples are proportional; i.e., samples of like size represent like amounts of grain.
- b. There are two common problem situations:
 - (1) **When grain is being loaded into a barge or ship**, the amount of sample that's obtained by an online sampling device (i.e., D/T) can vary from sample to sample depending on the elevator's load-out rate. As the load-out rate increases, the amount of sample obtained usually decreases. Consequently, one subsample may weigh 3,000 grams, while another subsample that represents the same amount may weigh only 2,000 grams.
 - (2) **When two or more separate trucklots, carlots, or lash bargelots are offered for inspection as a combined-lot**, the volume of grain in each of the carriers can range widely. But often-particularly if the lots are probe sampled--the individual lot samples will all be about the same size, regardless of the actual amount of grain in the individual lots. That is, a sample drawn from a 200,000-pound railcar lot will weigh the same as a sample drawn from a 150,000-pound railcar lot.
- c. Unless you are aware of such situations and take necessary precautions, a significant portion of a lot could be over- or under-represented. Before combining samples:
 - (1) Establish an acceptable sampling ratio (e.g., for each 5,000 bushels of grain there will be exactly 1,250 grams of sample). This ratio should be based on the minimum amount of sample that can be expected to be obtained from any single subsample or lot sample.
 - (2) Weigh (or visually-determine) the size of each sample before combining.
 - (3) If a sample weighs more than it should for the amount of grain it represents, reduce the sample so that it conforms to the established sampling ratio.

FOR EXAMPLE: If a D/T normally delivers 1,250 grams of sample for each (approximate 5,000 bushels of grain sampled, then *all* samples drawn from the lot must conform to the 1,250 grams-to-5,000 bushel ratio. Samples that are not reasonably proportional must be adjusted before being combined with other samples (“reasonably proportional” means the standard sample size $\pm 5\%$). The diagram below illustrates this example.



1.9 UNUSUAL CONDITIONS

- a. Do not allow yourself to be hurried to the point that the integrity of the sample is undermined or a condition, such as objectionable odor, insect infestation, or heating, is overlooked. Remember, obtaining a representative sample is the most important aspect of a sampler's job.
- b. If you suspect that the quality of the grain in the sample is not indicative of the true quality of the grain in the lot or that the carrier might be deceptively loaded (see FGIS Program Directive 907.5 for examples of deceptive practices), draw another representative sample using a slightly different sampling pattern or a longer probe, or draw an auxiliary sample.

NOTE: If deceptive loading is suspected, notify your supervisor as soon as possible.

- c. An auxiliary sample is drawn only for the purpose of determining if the lot's true condition is indicated by the representative sample.
 - (1) An auxiliary sample is used to "backup" the representative sample, not as another representative sample. For example, if you suspect that a hopper car containing grain is contaminated with fertilizer--even though no fertilizer was present in the probe sample--draw an auxiliary sample.
 - (2) Auxiliary samples may be obtained in any safe manner that is effective in obtaining a sample from the portion of the lot that is suspected of being contaminated or of being a distinctly different quality than the remainder of the lot; e.g., in a hopper car, an unusually long probe may be used or a well may be dug so that the bottom of the carrier can be reached.
 - (a) If an unusual condition is found in an auxiliary sample, identify the auxiliary sample with a separate sample ticket and submit the auxiliary sample along with the representative sample.
 - (b) The identification should indicate the specific location in the lot where the auxiliary sample was drawn. For example: "Auxiliary Sample, Compartment B-1, N&W 176186."

NOTE: Do not mix the auxiliary sample with the representative sample.

- d. If you observe any of the following conditions in a lot, a representative sample, or an auxiliary sample, report the condition on the sample ticket.
- (1) Angoumois Moths. If moths are found flying or crawling around the lot or the carrier, record an estimate of the number observed.
 - (2) Infestation. If weevils, grain borers, insect larvae, bran bugs, or other insects injurious to stored grain are found on, around, or about the lot, note the number, type, and location where observed.

NOTE: To aid in insect identification, refer to FGIS Interpretive Line Slides IN-1.0 through IN-30.0, "Insects Commonly Found in Grain." See Book II, Chapter 1, for more information.

- (3) Large Debris and Other Sample Grade Factors. If any of the following conditions are observed in a lot, record the amount, size, number (whichever is more applicable) and the location where found:
 - Large stones, large sticks, cobs, cement;
 - Pieces of metal, glass, or fertilizer;
 - Rodent or bird excreta;
 - Castor beans, crotalaria seeds, or cocklebur;
 - Lumps of grain, unknown foreign substance, toxic material, or unnatural odors (see Figure 1. "Odor Classification Chart"); and
 - Material too large to enter a probe.
- (4) (Heating Grain. When high temperatures develop in grain as the result of excessive respiration, such grain is called "heating." Heating grain usually gives off a sour or musty odor.
 - (a) Note the location and quantity on the sample ticket.

- (b) Do not confuse heating grain with grain that is warm due to storage in bins, cars, or other receptacles during warm weather.
- (5) Distinct Differences in Quality or Other Unusual Conditions.
Describe the condition in detail on the sample ticket.
- (6) Odors. Odors should be detected on the original sample at the time of sampling.
 - (a) In railyards and other locations where an inspector is not accessible, immediately place the suspect sample into an airtight container for transport to the laboratory for a examination by an inspector.
 - (b) Musty and sour odors are the result of mold growth or of fermentation and heating. These odors are indexes of deterioration in grain quality that materially lowers the grain's value to end users.
 - (c) Commercially objectionable foreign odors are the result of absorption by grain of residual odors from hides, oil, and other material. See Figure 1. "Odor Classification Chart" for a list of these and other odors that may be found in grain.

Sour	Musty	Commercially Objectionable Foreign Odors
Boot (bottom of leg) Pig pen Permenting Grain Insect Odor Heating Grain	Moldy Earth Ground Insect Odor Heating Grain	Animal hides Decaying Animal and Vegetable Matter Fertilizer Skunk Oil Products Smoke Weed Seed
CAUTION: DO NOT PLACE YOUR FACE OR NOSE IN GRAIN THAT HAS RECENTLY BEEN TREATED FOR THE PURPOSE OF DESTROYING INSECTS!		

Figure 1. Odor Classification Chart

U.S. DEPARTMENT OF AGRICULTURE
Grain Inspection, Packers and Stockyards Administration
Federal Grain Inspection Service
P.O. Box 96454
Washington, D.C. 20090-6454

GRAIN INSPECTION HANDBOOK
BOOK I
Probe Sampling
7-07-95

CHAPTER 2

PROBE SAMPLING

2.1	EQUIPMENT.....	2-3
2.2	GENERAL PROCEDURES	2-5
2.3	CARRIERS CONTAINING INFERIOR PORTIONS.....	2-8
2.4	SAMPLING PATTERNS.....	2-10
2.5	SAMPLING SACKED GRAIN.....	2-19
2.6	PROBE-TYPE MECHANICAL SAMPLER	2-20

PAGE LEFT BLANK INTENTIONALLY

2.1 EQUIPMENT

- a. Probe. Probes, sometimes referred to as triers, are constructed of brass or aluminum and come in various sizes, with standard lengths of 5, 6, 8, 10, and 12 feet. The depth of the carrier or container dictates the length of probe that is used to draw the sample.
- (1) Probes consist of two tubes, one inside the other. The inner tube is divided into compartments. Depending on its length, a probe may have 11, 12, 16, or 20 compartments. The outer tube has slots which match the compartment openings of the inner tube.
 - (2) When the slots in the tubes are aligned, grain can enter into and be emptied from the compartments.

Carriers	Probe Lengths	Compartments
Barges and Bay Boats	12-foot	20 compartments
Hopper Cars	10- or 12-foot	20 compartments
Boxcars	6-foot	12 compartments
Trucks	5- or 6-foot	11 or 12 compartments
Hopper-Bottom Trucks	6-, 8-, or 10-foot	12, 16, or 20 compartments
Other Containers - Use grain probes that will reach the bottom of the container.		

Figure 1. Grain Probes and Carrier Types

NOTE: Non-compartmented grain probes and open-ended grain probes are not approved for official sample-lot inspections but may be used for official commercial inspection.

- (3) Whenever the bottom of a carrier/container is not reached by **all** probes, show the special statement "Top ____ feet sampled. Bottom not sampled." on the sample ticket. The number of feet shown in the statement shall correspond to the **estimated average depth** of all probes that **did not** reach the bottom of the carrier.

FOR EXAMPLE: A sampler is unable to reach the bottom of a hopper car compartment after inserting the probe to its full 10-foot depth. The bottom of the next compartment is not reached after the probe is inserted 8 feet. In the last compartment, the probe reaches the bottom after being inserted 9 feet. Since the bottom of the container was not reached with all probes, add the depth of the two probes that did not reach the bottom (8 feet + 10 feet = 18 feet); then divide by the sum (18 ÷ 2 = 9 feet). Show "Top 9 feet sampled. Bottom not sampled." on the sample ticket.

b. Sampling Canvas or Cloth.

- (1) Sampling canvases, which are usually made of flat duck cloth or similar material, must be longer than the probe used to draw the sample. This "extra length" is needed so that the grain from the entire length of each probe may be placed on the canvas and examined without being spilled.

NOTE: Always keep sampling canvases clean, dry, and free of holes.

- (2) Half sections of pipe or troughs (e.g., rain gutters) may be used instead of sampling canvases. Troughs must be longer than the probe used to draw the sample.

c. Sample Bags. Sample bags must be constructed from heavy cloth or canvas, have a draw string closure, and should be large enough to contain up to 4,000 grams of grain.

- (1) Sample bags shall be free of all old grain, insects, and foreign material.
- (2) To prevent a change in moisture or odor, it is recommended that a plastic liner be inserted inside the sample bag. The sample ticket or other records should be inserted between the liner and the bag, not directly in the sample.
- (3) Containers, such as metal buckets or plastic cans, may be used instead of sample bags provided the containers are clean and dry.

Sampling Canvases	Sampling Bags
30 inches X 5½ feet	8 inches X 16 inches
30 inches X 6½ feet	8½ inches X 19 inches
30 inches X 10½ feet	9 Inches X 16 inches
30 inches X 12½ feet	10½ inches X 16½ inches

Figure 2. Standard Sizes of Sampling Canvases and Bags

2.2 GENERAL PROCEDURES¹

a. Prior to Sampling.

- (1) Record the carrier's identification number on the sample ticket.
- (2) Break any seals that secure hatches or doors that must be opened. Record the prefix code number of broken seals on the ticket.
- (3) Open the hatches/doors and enter the carrier.

NOTE: **The applicant for inspection is responsible for removing truck tarps, opening roll-top barges, and trimming (leveling) the grain in the carrier.**

- (4) After entering the carrier, visually examine the top of the grain for any debris, lumps, glass, and other harmful material. Take a handful of grain from several locations and check it for odor. Record any unusual conditions or off-odors on the sample ticket.
- (5) Next, spread the canvas on a level surface. Make sure the probe and canvas are clean and dry.

b. Drawing the Sample. For each type of carrier, there is an established sampling pattern (see section 2.4 of this chapter). Probe the carrier in the areas identified for the particular type of carrier. There are many techniques for using a probe. Regardless of which technique is used, follow these general rules to obtain a representative sample:

- (1) Insert the probe at a 10-degree angle from the vertical, with the slots facing

¹Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See Appendix 1, **Local Quality Control Programs**, for additional information.

upward and completely closed. Keep the slots closed until the probe is inserted as deeply as possible into the grain. If the slots are not kept closed, a disproportionate amount of grain from the top of the lot will fall into the probe's compartments as it is being inserted.

- (2) If the grain contains sand or grit, it is permissible to insert the probe with the slots facing downward to avoid "freezing" the probe. After the probe is inserted, turn the slots upward before opening.

NOTE: **At the discretion of the official agency or field office manager, nonlicensed personnel may assist official personnel in obtaining samples, provided that: (1) all nonlicensed personnel are under the direct, physical supervision of official personnel at all times; (2) the ratio of official personnel to nonlicensed personnel is reasonable and practical; and (3) official personnel determine the general condition of the grain and whether additional samples are needed due to quality differences.**

- (3) After the probe is fully inserted (with the slots facing upward), open the slots and move the probe up-and-down in two quick, short motions. When sampling grains, such as oats and barley, additional up-and-down movements may be necessary to fill the probe.
- (4) Close the slots completely. Then, grasp the probe by the outer tube and withdraw it from the grain.

CAUTION: **Do not pull the probe by the wooden handle. This can cause the inner tube to be pulled out of the outer tube. When this occurs, the probe must be emptied, reassembled, and the area re-probed.**

- (5) Empty the probe on the canvas and compare the grain in each compartment for uniformity of kind, condition, and infestation. Also, compare the sample to others drawn from the same lot. If all samples and portions of samples are uniform with one another, composite them in a sample bag with a completed sample ticket.

NOTE: **When using a trough, examine the grain in each compartment before emptying the probe sample into the trough.**

- (6) If the examination of the individual probe samples indicate that the grain is not uniform in condition (i.e., part of the lot is musty, sour, or heating), a sample from each of the different parts--in addition to a sample that represents the carrier as a whole--must then be drawn. See section 2.3 of this chapter.
- (7) When transferring the sample from the canvas to the sample bag, take care not to spill any portion of the sample or allow fine material to be blown away.
- (8) After placing the sample and completed sample ticket into the sample bag, tighten the drawstrings at the top of the bag so that it is closed securely. Carefully remove the bag from the carrier so that none of the sample is lost or spilled.

CAUTION: **Do not throw or drop the sample to the ground.**

- (9) Close all hatches or doors. Then, replace all broken seals with new seals--unless directed by the applicant for inspection not to do so. Record the prefix code and number of all seals applied on the sample ticket.

2.3 CARRIERS CONTAINING INFERIOR PORTIONS

- a. One of the most common errors in sampling is failing to obtain the required number of samples from a lot that appears to contain an inferior portion; e.g., musty, sour, or heating grain.
- b. Whenever a lot appears to contain an inferior portion, the sampler must draw **three** separate samples: a sample of the entire lot, a sample of the inferior portion, and a sample of the remainder of the lot. The absence of any one of these samples gives the inspector an incomplete picture of the grain in the carrier.

NOTE: **Each of the three samples must contain a minimum of 2000 grams of grain and be accompanied by a completed sample ticket.**

- c. Draw the three samples as follows:
 - (1) First, determine the boundaries of the inferior portion. This is done by repeated sampling and examination of individual probe samples.
 - (2) Once the boundaries have been found, draw a sample of the inferior portion, a sample of the remainder, and a sample of the entire lot.
 - (3) Estimate the approximate amount of grain represented by each sample and note the location of the grain in the carrier. The estimate is made using fractional parts, such as $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, to indicate the portion of the lot represented by each sample. The probe can be useful in performing this task.
 - (a) To form a fraction using the probe, count the number of compartments containing the inferior grain and place that number over the total number of filled compartments.
 - (b) Reduce the fraction to its lowest form. This is the fractional part containing the inferior grain.
 - (c) Show this information, with a rough diagram of the portions, on the respective sample ticket completed for each sample.
 - (d) Note on the sample ticket the location of the inferior portions of grain in terms such as: Hopper cars - B-1 (the bay or compartment closest to the brake end), B-2 (the middle hopper), B-3 (the compartment opposite the brake end); and Barges - stern end, bow end, port, or starboard.

FOR EXAMPLE: An inferior portion has been found in a truck-lot of grain. Numbers 1, 2, 3, 4, 5, 6, and 7 represent the regular probe pattern. The letters a, b, c, d, e, f, g, h, i, and j represent additional probes taken. This should give the sampler an indication of the size and location of the inferior portion. However, if you believe that more samples are needed, then they should be taken. The proper procedure for estimating the fractional portions of inferior grain in the lot is to count the compartments of good grain and the compartments of inferior grain. Show the count on the back of the sample ticket.

F	1	a	2	b	3	c
R						
O-	d	e	f	4	g	h
N						
T	i	5	j	6	k	7

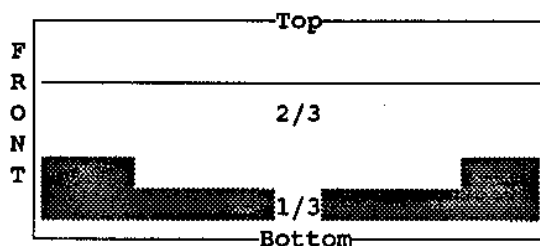
F	8/4	8/4	9/3	9/3	8/4	7/5
R						
O-	8/4	8/4	9/3	9/3	8/4	8/4
N						
T	7/5	8/4	8/4	8/4	7/5	7/5

Example: The procedure for computing the fractional portion of inferior grain in the lot is as follows: There are 144 compartments of sound grain and 72 compartments of inferior grain, total compartments in 18 probes using a 6 foot probe is 216.

$$\frac{144}{216} \div 4 = \frac{36}{54} \div 18 = \frac{2}{3} \quad 2/3 \text{ of the lot consists of good grain.}$$

$$\frac{72}{216} \div 4 = \frac{18}{54} \div 18 = \frac{1}{3} \quad 1/3 \text{ of lot consists of inferior grain.}$$

The drawing for the above lot would be similar to the one shown below.



NOTE: The aforementioned procedure may be modified and used to estimate inferior portions on all carriers sampled with a probe.

2.4 SAMPLING PATTERNS¹

- a. The following diagrams show the standard sampling patterns. Each lot shall be probed in as many additional locations as are necessary to assure that the sample is the required size and representative of the lot.
- (1) Additional probes shall be drawn in a balanced manner. For example, one compartment of a hopper car shall not be probed twice unless the other compartments are also probed twice, regardless of the amount of grain in any one compartment or the amount of additional sample needed.
 - (2) The sampling patterns in this section shall be used by all official inspection personnel when sampling grain at rest. Insert the probe at the points marked (X), with the tip of the probe pointed toward the direction of the arrow head. When two arrow heads are shown, the tip of the probe may be pointed in either direction.
- b. Sampling Patterns for Barges.
- (1) Fiberglass Hatch Top Barges. Draw one probe sample from each opening in the direction of the arrow head. Insert the probe in the center of the opening, approximately 7 feet from the side edge.

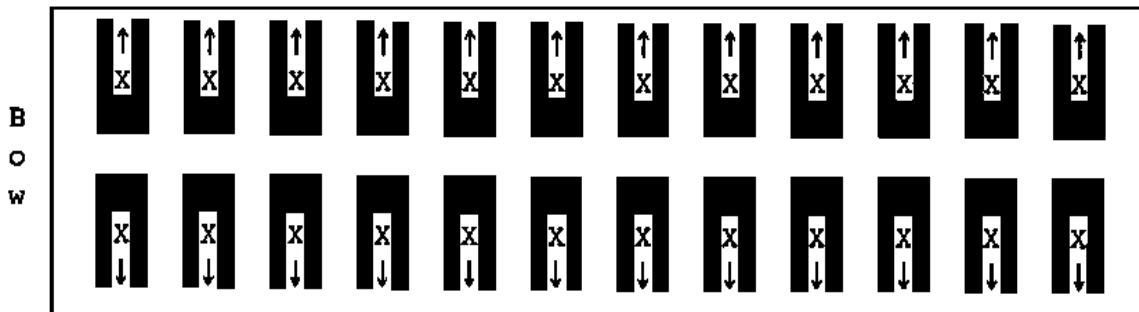


Figure 3. Fiberglass Hatch Top Barge

¹See footnote 1 on page 2-3 and Appendix 1, **Local Quality Control Programs.**

- (2) Lift Top and Roll Top Barges. Draw the first probe approximately 4 feet in from the stern end of the barge and approximately 7 feet from the side. Take the next probe approximately 15 feet from the first probe. Proceed to take probes at 15-foot intervals until the bow end of the barge is reached. The last probe shall be taken approximately 4 feet from the opposite end and approximately 7 feet from the side. Sample both sides of the barge in this manner until the entire barge is sampled.

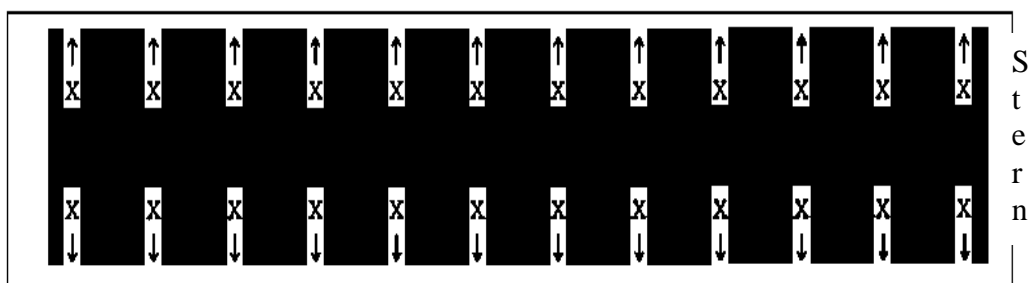


Figure 4. Lift Top and Roll Top Barge

- (3) Other Types of Barges. When sampling barges other than those listed above, use the sampling pattern that will provide the most representative sample.
- (4) Probe Sampling Barges During Loading.
- (a) Using the prescribed pattern, sample up to the point that the barge is fully loaded.
 - (b) Mark this point on the side of the barge.
 - (c) Place the sample in an airtight container.
 - (d) After the next section(s) is loaded, sample from the point marked to the point that loading stopped.
 - (e) Place this sample in a separate container.
 - (f) Repeat the procedure until loading is completed. If all samples are uniform, combine them into one sample.

c. Sampling Patterns for Hopper Cars.

- (1) 3-Compartment, Trough or Door Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle, the probe may be inserted either in the center of each hopper or slightly off center in order to miss the cross beam.

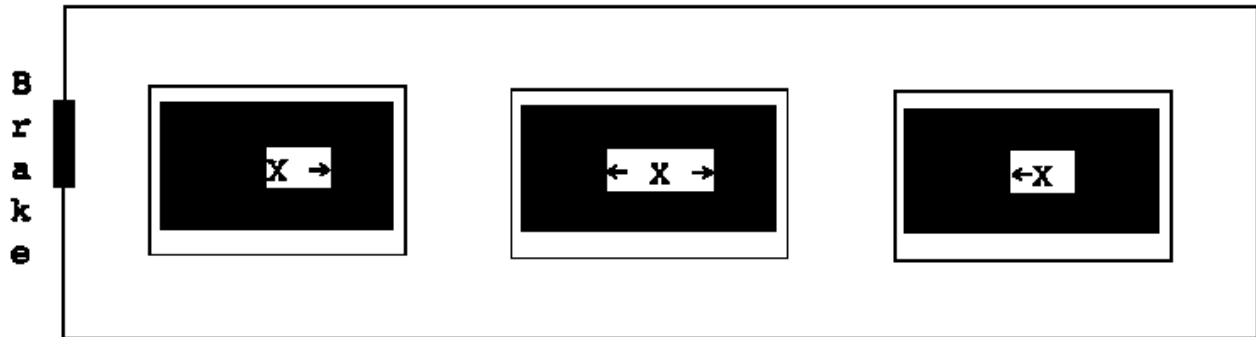


Figure 5. 3-Compartment, Trough or Door Type Hopper Car

- (2) 3-Compartment, 10-Hatch Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle.

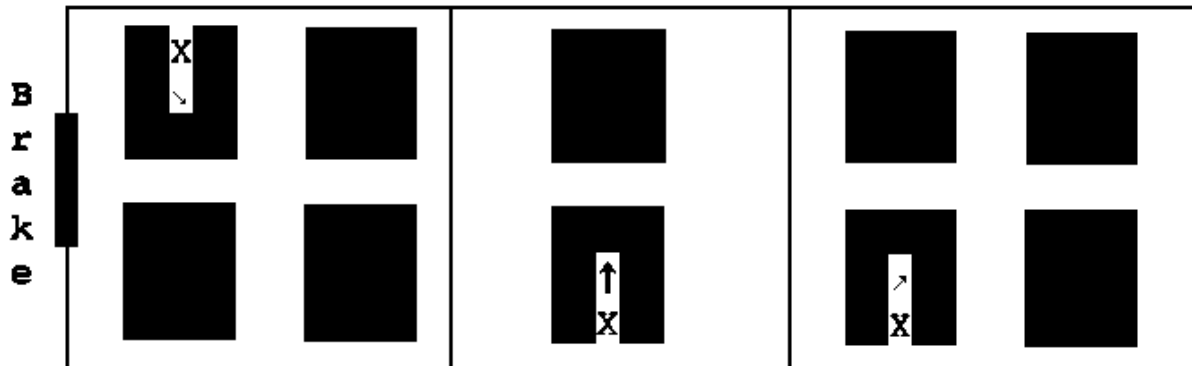


Figure 6. 3-Compartment, 10-Hatch Type Hopper Car

- (3) 2-Compartment, 8-Hatch Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle.

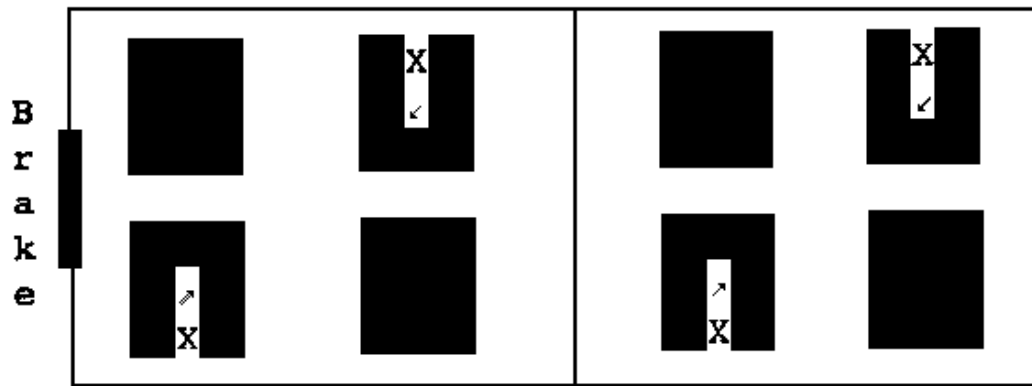


Figure 7. 2-Compartment, 8-Hatch Type Hopper Car

- (4) 2-Compartment, Open Top Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle.

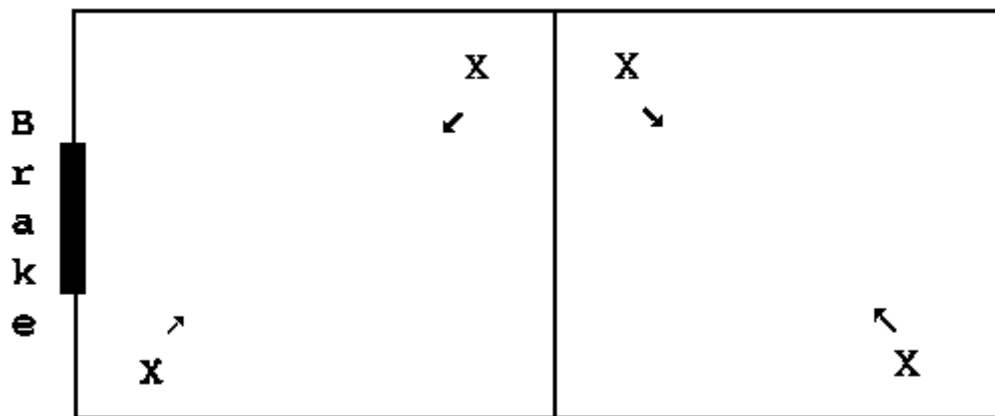


Figure 8. 2-Compartment, Open Top Hopper Car

- (5) 4-Compartment, 12-Hatch Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle.

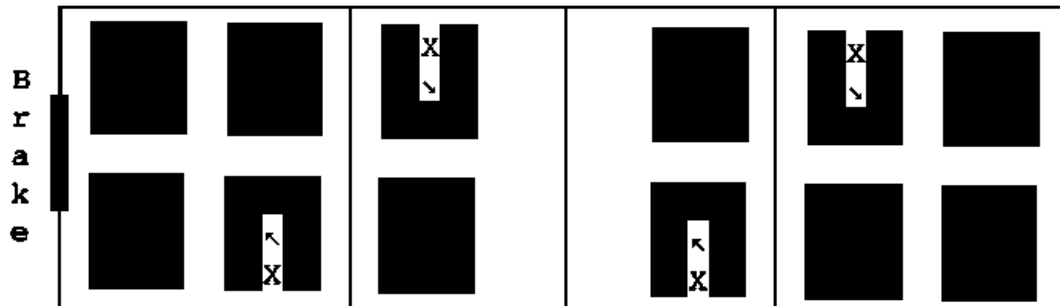


Figure 9. 4-Compartment, 12-Hatch Type Hopper Car

- (6) Articulated Type Hopper Cars. Insert probe in the direction of the arrow at an approximately 10 degree angle.
- Articulated type hopper cars (e.g., "Super Hoppers") are easily recognized because of their configuration. The car's design permanently mounts five, 2-hatch type hopper cars onto 6 sets of wheels. The five car units carry the equivalent of three jumbo hopper cars.
 - Since articulated hopper cars are unique in design, samplers should also be aware that their identification system is different from that of standard hopper cars. Often articulated hopper car units are labeled by the manufacturer. If they are, use this information for identification. If they are not labeled, identify one end unit of the car as the A unit and identify the other end unit as the B unit. Then, identify the three middle units as C, D, and E, going from unit B to unit A. Each unit has two compartments or hoppers. The B-end compartment within a unit is identified as 1 and the A-end unit within the same compartment is identified as 2. See the diagram on page 2-15.

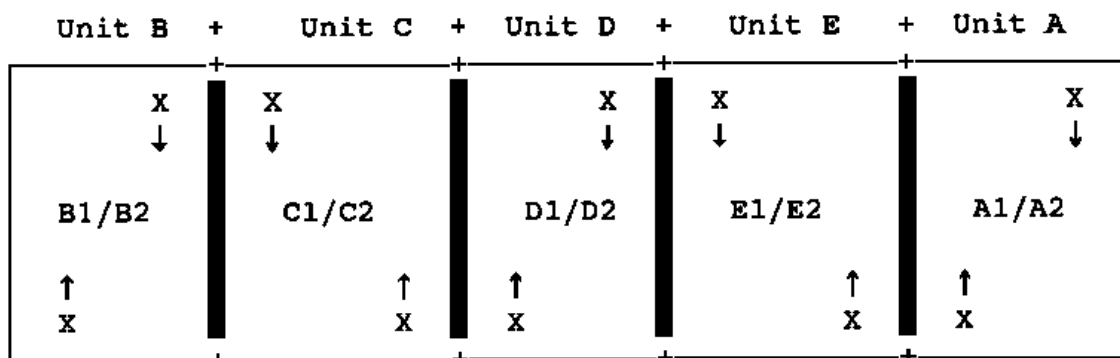


Figure 10. Articulated Type Hopper Car

- (7) Other Types of Hopper Cars. When sampling other types of hopper cars, use the sampling pattern which will provide the most representative sample.
- d. Sampling Pattern for Box Cars. Insert the probe at an approximately 10 degree angle in the direction of the arrows shown in the diagram. The probe pattern shown may also be used in reverse of the one shown.

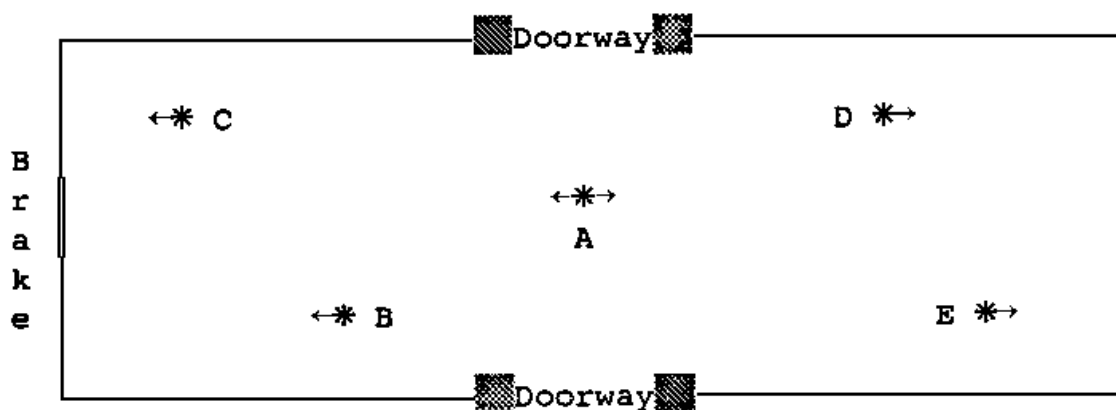


Figure 11. Boxcar

Site A - Draw a sample from the center of the car. The probe may be taken with the slots facing toward either end of the car.

Site B - Draw a sample approximately 3 - 5 feet back from the doorpost and approximately 2 - 4 feet out from the side of car. The slots in the probe face toward the end of the car.

Site C - Draw a sample approximately 3 - 5 feet from the same end of the car and approximately 2 - 4 feet from the opposite side of the car from site B. The slots in the probe face toward the end of the car.

Site D - Draw a sample approximately 3 - 5 feet back from the doorpost and approximately 2 - 4 feet out from the side of car opposite of site B. The slots in the probe face toward the end of the car.

Site E - Draw a sample approximately 3 - 5 feet from the same end of the car and approximately 2 - 4 feet from the opposite side of the car from site D. The slots in the probe face toward the end of the car.

- e. Sampling Patterns for Trucks. Insert the probe at an approximately 10 degree angle in the direction of the arrows shown in the diagram. The probe pattern shown may also be used in reverse of the one shown.
- (1) Flat-Bottom Trucks or Trailers Containing Grain More than 4-Feet Deep or 8 Filled Probe Compartments.

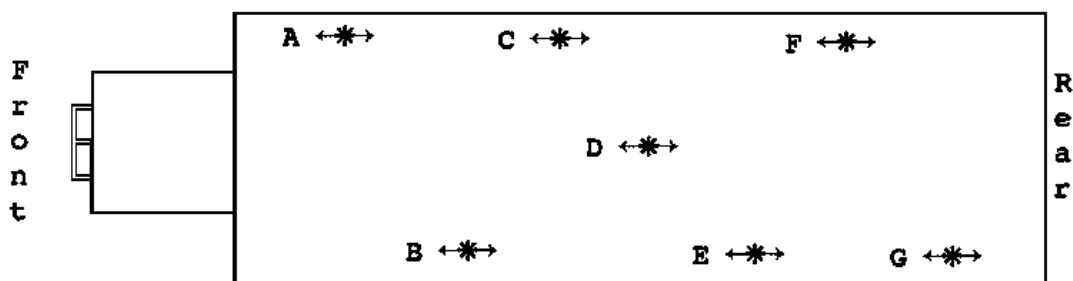


Figure 12. Flat Bottom Truck or Trailer

Site A - Draw a sample approximately 2 feet from the front and side.

Site B - Draw a sample from the opposite side of site A, approximately halfway between the front and center of the carrier, and approximately 2 feet from the side.

Site C - Draw a sample from the same side as site A, approximately $\frac{3}{4}$ (three-fourths) of the distance between the front and center of the truck and approximately 2 feet from the side.

Site D - Draw a sample from the center of the carrier.

Site E - Draw a sample from the side opposite site C, approximately $\frac{3}{4}$ (three-fourths) of the distance between the rear and center, approximately 2 feet from the side.

Site F - Draw a sample from the side opposite site E, approximately one-half the distance between the rear and center, approximately 2 feet from the side.

Site G - Draw a sample from the same side as site E, approximately 2 feet from the rear and side of the carrier.

- (2) Flat-Bottom Trucks or Trailers Containing Grain Less than 4-Feet Deep or Fewer than 8 Filled Probe Compartments.

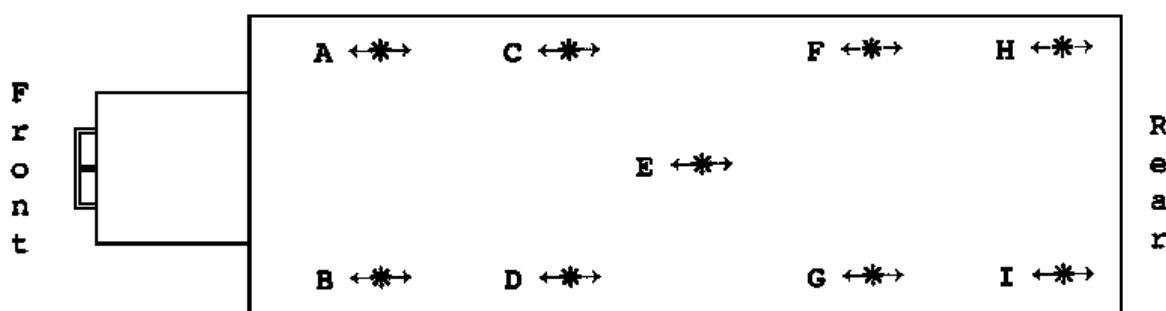


Figure 13. Flat Bottom Truck or Trailer

Site A - Draw a sample approximately 2 feet from the front and side.

Site B - Draw a sample from the opposite side of site A, approximately 2 feet from the side.

Site C - Draw a sample from the same side as site A, approximately $\frac{3}{4}$ (three-fourths) of the distance between the front and center of the truck and approximately 2 feet from the side.

Site D - Draw a sample from the same side as site B, and opposite of site C, approximately $\frac{3}{4}$ (three-fourths) of the distance between the front and center, approximately 2 feet from the side.

Site E - Draw a sample from the center.

Site F - Draw a sample from the same side as site C, approximately $\frac{3}{4}$ (three-fourths) of the distance between the center and rear of the truck and approximately 2 feet from the side.

Site G - Draw a sample from the same side as site D, approximately $\frac{3}{4}$ (three-fourths) of the distance between the center and rear of the truck and approximately 2 feet from the side.

Site H - Draw a sample from the same side as site F, approximately 2 feet from the rear and side of the carrier.

Site I - Draw a sample from the same side as site G, approximately 2 feet from the rear and side of the carrier.

- f. Sampling Pattern for Hopper-Bottom Containers, Trucks, and Trailers. Insert the probe at an approximately 10 degree angle in the direction of the arrows shown in the diagram.

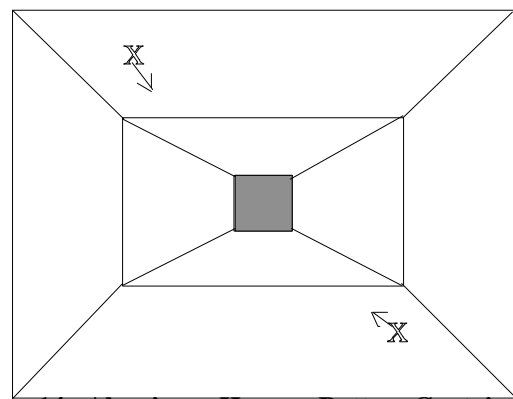


Figure 14. Aluminum Hopper-Bottom Container

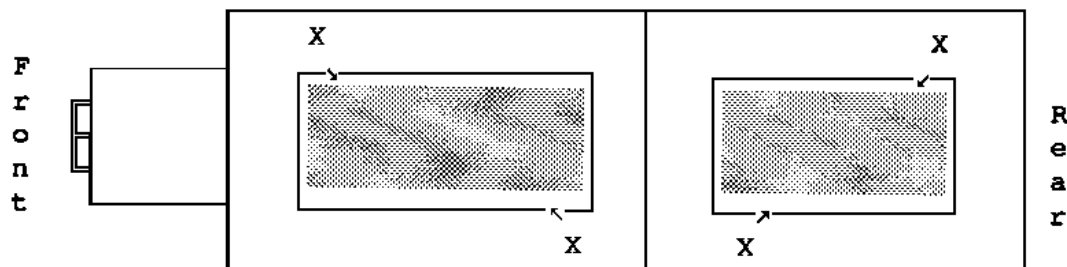


Figure 15. Hopper-Bottom Truck and Trailer

2.5 SAMPLING SACKED GRAIN

When sampling sacked grain, use a double-tubed, compartmented grain probe (minimum length: 4-feet).

CAUTION: When working in warehouses, watch out for forklifts and tow-motors. Also be alert for sacks slipping (falling) from improperly stacked pallets.

- a. Determine the number of sacks in the lot. If the lot contains more than 10,000 sacks, divide the lot into 2 or more (approximately) equal-sized sublots.
- b. For each lot or subplot, randomly select **36** sacks for sampling.

NOTE: All sacks in the lot must be accessible for selection.

- c. Stand each selected sack on end and insert the probe into the top corner of the sack.
- d. Push the probe, with the slots facing upward, diagonally through the sack until the end of the probe touches the opposite bottom corner.
- e. Open the probe, make two quick up-and-down motions, and then close and remove the probe.
- f. Empty the contents of the probe onto a sampling canvas and examine the grain for condition.
- g. If all probe samples are uniform with one another, composite the samples and place into one sample bag.
- h. If the examination of the probe samples indicate that the lot is made up of distinctly different parts in regard to condition, draw a sample from each of the different parts, in addition to the sample as a whole.

NOTE: For more information on the sampling sacked grain, refer to FGIS Instruction 918-41, Sacked Grain.

2.6 PROBE-TYPE MECHANICAL SAMPLER¹

- a. Periodically, examine the sampling system--including the delivery pipes and the sample collection box--to ensure that the system is not clogged-up, leaking, or contains grain and other material from previous lots.
- b. Using the standard sampling pattern (refer to section 2.4), draw one sample from each probe site.

NOTE: If the sampler is not owned by the official agency, it may--at the owner's discretion--be operated by an elevator employee under the direct supervision of official personnel.

- (1) Insert the probe vertically into the grain until it reaches the bottom of the carrier. **Extreme care must be exercised when inserting the probe to prevent damage to the bottom of the carrier--don't continue to exert downward pressure after reaching the bottom.**
- (2) Once the probe has been fully inserted, transfer the sample to the collection box. (Many probes have limit switches that automatically "cycle" the probe and transfer the grain to the collection box.)
- (3) During sampling operations, keep a constant check for possible system malfunctions. Be aware of any change in the sample:

--If the sample flow stops but the vacuum motor is laboring, the delivery system may be plugged;

--If the sample becomes noticeably smaller but the vacuum motor is running freely, the system may have a leak.

NOTE: Carriers with shallow loads may need to have additional probes taken to obtain the proper amount of sample. Draw additional probes in a representative manner; e.g., one portion of a trucklot shall not be probed twice unless the entire truck is probed twice.

- (4) After all samples are drawn, empty the sample collection box and examine the grain for unusual conditions, such as off-odors, heating, infestation, and nonuniformity.

NOTE: Probe-type mechanical samplers are only approved for sampling trucks. Requests for sampling other types of carriers should be forwarded to FGIS Headquarters.

¹See footnote 1 on page 2-3 and Appendix 1, **Local Quality Control Programs.**

U.S. DEPARTMENT OF AGRICULTURE
Grain Inspection, Packers and Stockyards Administration
Federal Grain Inspection Service
P.O. Box 96454
Washington, D.C. 20090-6454

GRAIN INSPECTION HANDBOOK
BOOK I
Probe Sampling
7-07-95

CHAPTER 3

SAMPLING WITH A DIVERTER-TYPE MECHANICAL SAMPLER

3.1 GENERAL INFORMATION	3-3
3.2 D/T CHECKS	3-4
3.3 SECURITY	3-7
3.4 GRAIN QUALITY CHECKS	3-8

Attachment 1, "Trouble Shooting Guide for Samplers"

PAGE LEFT BLANK INTENTIONALLY

3.1 GENERAL INFORMATION

- a. Diverter-type (D/T) mechanical samplers may be mounted in grain spouts, at the end of belts, or at the head of elevator legs. Regardless of their location, all D/T's draw a sample in the same way--by periodically moving a diverter (often called the "pelican") completely across a stream of grain.
 - (1) The frequency that the pelican moves through the grain, or takes a "cut," is controlled by a timing device. Grain collected by each "cut" of the pelican flows to a secondary sampler (SM) which reduces the sample size. From the SM, the sample flows to a collection box.
 - (2) For further information about D/T samplers, refer to the FGIS Mechanical Sampling Systems Handbook (MSSH).
- b. D/T sampler attendants are responsible for:
 - (1) Ensuring that the D/T sampler and sampling system are functioning properly. (See section 3.2, "D/T Checks.")
 - (2) Securing D/T sampling system access points and grain flow diversion points. (See section 3.3, "Security.")
 - (3) Checking the grain during loading/unloading for infestation, condition, and uniformity. (See section 3.4, "Grain Quality Checks.")
 - (4) When sampling outbound grain, performing a prior-to-loading stowage examination of the carrier or container. (See FGIS Program Directive 918.48, "Stowage Examination Services.")

3.2 D/T CHECKS

a. Prior-to-Use Checks¹

Each workday before using the D/T, physically examine the sampling system, including the elevator load-out/in system, to make sure that the sampling system is operating properly and all previously applied security seals/locks are still intact. This shall include, but not be limited to, the following checks:

- ☉ **General System Check.** Examine the primary sampler, secondary sampler, and the sample delivery system (i.e., sample delivery tube and collection area) to ensure that they are working properly and are free from noticeable obstructions and leaks.
- ☉ **Pelican/Dust Seal Check.**
 - ... Check the movement of the pelican; e.g., is it smooth.
 - ... Check the dust seals for wear and tear.
 - ... Check for objects stuck in the pelican opening or body.
 - ... Check that the pelican fits against the dust seals.

CAUTION: Follow appropriate lockout procedure before opening either the primary or the secondary sampler inspection doors

- ☉ **Grain Flow System Check.** Examine elevator load-out/in belts, trippers, turnheads, garners, scales, and bins to ensure that they are properly configured and free of residual grain and foreign material.
- ☉ **Timer Check.** Check the timer on the D/T sampler control panel to ensure that it is set for (and takes a cut at) the correct time interval. (Refer to the FGIS Mechanical Sampling Systems Handbook for timer setting requirements.)
- ☉ **Security Check.** Check all D/T system access points and grain flow diversion points to ensure that all security seals/locks are in place.

b. In-Use Checks.

- (1) During sampling operations, keep a constant check for possible system malfunctions. Be especially aware of any change in the sample:
 - ✓ If the sample flow stops, the delivery system may be plugged;

¹ Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See Appendix 1, **Local Quality Control Programs**, for additional information.

- ✓ If the sample contains an unusual amount of dust or foreign material, the dust seals may be torn or worn; or
- ✓ If the sample continues to dribble, even when the D/T control panel lights indicate that the pelican is not moving, then the pelican may not be resting properly against the dust seals.

NOTE: For a list of common problems, see Appendix--Trouble Shooting Guide for Samplers.

- (2) If you suspect a problem, **STOP USING THE D/T** immediately and inform your supervisor and the elevator manager of the situation. Then, inspect the D/T sampling system. If the inspection indicates that there is a physical or mechanical problem with the system:
 - (a) Discontinue use of the D/T until the problem is corrected and the sampler has been fully examined and/or tested. Sample the remainder of the lot using an Ellis cup or pelican sampler, or re-sample the entire lot using a probe. Note on the sample ticket the amount of grain sampled by the D/T and the amount sampled by another device.
 - (b) Document the problem, repair, and all subsequent activities. Keep a copy of all documentation at the specified service point and, when practicable, at the elevator/work site.
- c. Monthly Checks at Export Port Locations. Once a month, at a minimum, official personnel must physically check all security seals/locks and perform a general condition check of all D/T's used to sample export grain at export port locations. (On months when it is performed, the semi-annual examination shall also be considered to be the monthly check.)
 - (1) Examine the site for unauthorized modifications, such as unauthorized dust collection equipment or the addition of airvents.
 - (2) Stop the sampler with the pelican positioned so it can be inspected and gauged. This may be mid-spout or parked at the side, depending on the location of the inspection door.
 - (3) Follow appropriate lockout procedures.
 - (4) Record seal or lock identification numbers. Open the primary and secondary sampler inspection doors.
 - (5) Examine the pelican for damage. Use the go-no-go gauge to check for the correct pelican opening (3/4 to 7/8 inch).
 - (6) Check that the dust seals are undamaged.

- (7) Check for objects stuck in the pelican opening or body.
- (8) Check the secondary sampler and delivery tube for plugs.
- (9) Release the equipment from lockout using appropriate procedures.
- (10) Using the panel controls, energize the sampler to allow the pelican to come to rest under the left dust seal. Turn off the power. Open the inspection door. Don't place your hands or tools in the sampler.
- (11) Visually determine if the pelican rests against the left dust seal. Repeat for the right dust seal.
- (12) Reseal or lock the inspection plates, record the seal or lock identification numbers. **Record the results of the monthly check in a logbook:** include the date and your name or initials. (When a semi-annual examination is performed instead of the monthly check, write "See semi-annual exam file for (month) check results." in the logbook.) Maintain the logbook at the work site, under control of official personnel.
- (13) If physical or mechanical problems (e.g., torn dust seals or bent pelican) are observed, do not use the sampler until the problems have been corrected. Inform your supervisor and elevator management. Document the problem, the repair, and all subsequent activities.

d. Semi-Annual Examinations.

- (1) Once every 6 months or after any major repairs or alterations, official personnel must perform a detailed and comprehensive examination of all D/T sampling systems. Closely coordinate the scheduling of this examination with the elevator management.
- (2) The semi-annual examination shall encompass the items listed on form FGIS-936, "Sampler Condition Report," and any other items deemed necessary.
- (3) If physical/mechanical problems are observed, do not use the D/T until the problems are corrected. Inform your supervisor and the elevator manager of the D/T's status. Document the problem, the repair, and all subsequent examinations. Keep a copy of all documentation.

e. Performance Tests. Prior to authorizing new D/T sampling systems and, in some cases, before using systems with suspended authorizations, official personnel must check the performance of the system according to the procedures in the FGIS Mechanical Sampling Systems Handbook. Whenever a performance test is required, a semi-annual examination must also be performed.

3.3 SECURITY¹

- a. Controlling System Access and Diversion Points. Seal or lock all D/T sampler and sampling system access points (e.g., inspection plates and pipe connections) and elevator load-out/in diversion points (e.g., turnheads) that cannot be visually or electronically monitored by official personnel.

NOTE: Generally, use security seals--not locks--unless official personnel are always onsite.

- b. Broken Seals/Locks.

- (1) If the elevator manager informs you that elevator personnel broke one or more security seals/locks in the course of normal operations (e.g., replacing a torn D/T dust seal), physically examine the affected area or equipment and, if satisfied that the integrity of the D/T sampling system is not compromised, replace the broken security seals/locks;
- (2) If the elevator manager does not inform you that any security seals/locks are broken, but on subsequent investigation you find one or more broken security seals/locks, determine if there is a reasonable explanation:

If there is--physically examine the affected area or equipment and, if satisfied that the integrity of the D/T sampling system is not compromised, replace the broken security seals/locks.

If there isn't--suspend the D/T's authorization, and inform your supervisor and the elevator manager.

If you are unsure--contact your supervisor or the local FGIS field office manager.

- (3) Document the situation, including the reason (if known) the seals/locks were broken, and all seal/lock numbers (broken and new). Keep a copy of all documentation at the specified service point and, when practicable, at the elevator/work site.
- (4) If suspended, the D/T system must undergo a complete semi-annual examination before being returned to service. When deemed necessary, official personnel may also require that a performance test, as described in the FGIS Mechanical Sampling Systems Handbook, be performed.
 - (a) After a suspended system has been returned to service, physically check the security seals/locks on a daily basis until the next semi-annual examination.
 - (b) If the sampling system security is not compromised during this 6-month period, return to checking seals and locks on a periodic basis.

¹ See footnote 1 on page 3-2 and Appendix 1, **Local Quality Control Programs**.

3.4 GRAIN QUALITY CHECKS ¹

When sampling grain being loaded into or unloaded from a unit train (Cu-sum only), a fleet of lash barges (Cu-sum only), a standard-size (river) barge, or an ocean-going vessel:

- a. Periodically, monitor elevator operations to ensure that the sample being collected represents the lot being loaded/unloaded.
- b. Examine subsamples and component samples for heating, "distinctly low quality" (DLQ), unusual conditions, odor, and infestation. If inspected under the Cu-sum plan, check grading factors. (See figure 1, page 3-9.)

NOTE: If it not possible to examine subsamples/component samples at the collection site, examine them later at an inspection laboratory.

- (1) At least once every 5,000 bushels, remove the grain sample from the collection box or container. This sample is called a subsample.
- (2) Determine if the subsample is heating, DLQ, has any unusual condition, or has a musty, sour, or commercially objectionable foreign odor.

NOTE: Subsamples may also be examined for insects injurious to stored grain. If this procedure is used, the total number of insects found in all sub-samples comprising the component shall be used to determine if the component is "infested". For instance, if one weevil is found in the first sub-sample and one in the second, the component has two weevils and is considered to be "infested". If the sub-samples are checked for insects, it isn't necessary to combine sub-samples and examine component samples.

- (3) If the subsample is found to be heating, DLQ, have an unusual condition, or have an off-odor, complete a sample ticket that notes the condition found. Then, place the sample--with the sample ticket--in a separate container and notify your supervisor and the elevator manager immediately.
- (4) If the subsample is in sound condition, then it may be combined with the next consecutively-drawn subsample(s) to form a component sample. A component sample represents approximately 10,000 bushels of grain and should be approximately 2,500 grams in size.
- (5) Sieve the component sample and then check the grain on top of the sieve and the material that passed through the sieve for insects. Don't sieve more than 1,000 grams at a time.
 - * Use an 8/64-inch round-hole sieve for corn and soybeans.
 - * Use a .064-inch X 3/8-inch oblong-hole sieve for other grains.

¹ See footnote 1 on page 3-2 and Appendix 1, **Local Quality Control Programs**.

- * With the approval of both the official agency and the local FGIS field office manager, other sieve sizes may be used if needed to optimize particle separation and enhance the examination process.
- (6) If insects are detected, note the kind and number of insects found on a sample ticket. Then, place the sample--with the sample ticket--in a separate container and notify your supervisor and the elevator manager immediately.
- (7) If the component sample doesn't contain any insects injurious to stored grain, then it may be combined with another component sample(s) to form a subplot or lot sample.
- c. Monitor the grain stream, as practical, for foreign material too large to enter the D/T and SM samplers, such as cobs, coal, concrete, stones, wood, paper, glass, lumps, and dead animals. If large foreign material is present in the grain stream, immediately inform your supervisor and the elevator manager. Document your observation on the sample ticket.

NOTE: DO NOT ATTEMPT TO REMOVE OBJECTS FROM THE GRAIN STREAM.

CARRIER(S)	FREQUENCY OF EXAM (Approximate)	FACTOR(S) ANALYZED
Ships/Lash Barges (Cu-sum)	Maximum 5,000 bushels (Subsample)	Odor, heating, DLQ, unusual conditions
	Minimum 10,000 bushels (Component)	Grading factors <u>1</u> / Infestation <u>2</u> /
Unit Trains (Cu-sum)	Individual car basis (Subsample/Component)	Grading factors <u>1</u> / infestation <u>2</u> / DLQ, heating, unusual conditions
Articulated Railcars (Cu-sum)	Individual "unit" basis (Subsample/Component)	
Articulated Railcars (Single-lot)	Individual "unit" basis	Infestation <u>2</u> / heating, DLQ, unusual conditions
Standard Railcars (Single-lot)	Individual car basis	Infestation <u>2</u> / heating, DLQ, unusual conditions
Barges (Single-lot & Cum-sum)	Maximum 5,000 bushels (Subsample)	Odor, heating, DLQ, unusual conditions
	Minimum 10,000 bushels (Component)	Infestation <u>2</u> /
Trucks (Single-lot)	Individual truck basis	Infestation <u>2</u> / heating, DLQ, unusual conditions

Figure 1. Sample Analysis Intervals

1 Under the Cu-Sum plan, examine for "more than a two grade difference in grade factor results" (see FGIS [Grain Inspection Handbook](#), Book III, for more information about checking the quality of grain loaded aboard ships, lash barges, and unit trains).

2 Tolerances apply to individual trucks, railcars, rail "units," and barge/ship/unit train components. Minimum sampling rate for bargelots/shiplots is 500 grams for each 2000 bushels sampled.

RESERVED

TROUBLE SHOOTING GUIDE FOR SAMPLERS

<u>INCIDENT</u>	<u>POSSIBLE CAUSE AND ACTION</u>
<ol style="list-style-type: none"> 1. Grain does not flow into collection box or only dribbles. 2. Grain flows into collection box, but when collected, the sample is not the normal/proper size (i.e., there is more or less grain than usual.) 	<ol style="list-style-type: none"> 1 – 2. The sample delivery system and/ or the grain flow system is: (1) clogged with lumps of grain or dust, (2) leaking, (3) plugged with stones or other debris too large to enter the pelican, or (4) not operating properly because the timer is set incorrectly. Notify the elevator manager of problem. Check operation and/or set timer.
<ol style="list-style-type: none"> 3. Grain in the collection box contains an unusual amount of dust or foreign material. 	<ol style="list-style-type: none"> 3. If the delivery system is secure and tight, then the dust seals may not be properly installed or they may be worn or torn. Have elevator manager check, replace, or reinstall dust seals.
<ol style="list-style-type: none"> 4. The control panel indicates that the D/T pelican is at rest, but grain continues to dribble into the collection box. 	<ol style="list-style-type: none"> 4. The pelican is not properly seating/resting against the dust seals, dust seals are worn, or dust seals are torn. Have elevator manager align pelican or replace/reinstall dust seals.
<ol style="list-style-type: none"> 5. The sampling area is dirty and/or contains spilled grain, debris, or other obstructions. 	<ol style="list-style-type: none"> 5. Ask the elevator manager to have the area cleaned.
<ol style="list-style-type: none"> 6. The lighting in the sampling area is poor or the lighting is inadequate to properly perform sampling duties. 	<ol style="list-style-type: none"> 6. Ask the elevator manager to replace the bulbs or replace the light fixtures in the effected area.
<ol style="list-style-type: none"> 7. The D/T sampling system breaks down during the sampling of an export cargo grain shipment and there is no other D/T sampling system available. 	<ol style="list-style-type: none"> 7. Sample the remainder of the lot with either a pelican or Ellis cup sampler.

<u>TROUBLE SHOOTING GUIDE FOR SAMPLERS (CONTINUED)</u>	
<u>INCIDENT</u>	<u>POSSIBLE CAUSE AND ACTION</u>
8. The D/T sampling system fails during the sampling of a domestic grain lot. No other D/T sampling system available.	8. Sample the remainder of the lot with an alternative sampling device. Show the actual sampling method(s) used on the sample ticket regardless of the time or amount of grain loaded after D/T failure.
9. The D/T sampling system is making an unusual noise and/or becomes hot during operation.	9. This is a potentially hazardous condition. Leave the sampling area immediately and notify the elevator manager.
10. Air pressure and/or voltage is low with or without a load (e.g., pelican slows).	10. Notify the elevator manager.
11. A sample is spilled, thrown, dropped, stored in an improper manner, or stored in an area not under control of official personnel.	11. Immediately notify your supervisor. Such samples are no longer representative. The sample may, however, be inspected as a submitted sample.
12. Angoumois moths are found flying or crawling around the lot.	12. Estimate the number of moths observed and record on the sample ticket.
13. Insect infestation is found in, on, or about the lot/carrier.	13. Record the number and type of insects on the sample ticket.
14. Large stones and sticks, pieces of metal, fertilizer, or rodent or bird excreta are found in, on, or about the lot/carrier.	14. Record, as applicable, the amount, size, number, and the location of such material on the sample ticket.
15. Heating grain is found.	15. Record the location and quantity of heating grain on the sample ticket.
16. An unusual condition is observed that may affect the quality of the lot.	16. Describe the condition, in detail, on the sample ticket.
17. An off-odor is detected.	17. Describe odor on the sample ticket.

U.S. DEPARTMENT OF AGRICULTURE
Grain Inspection, Packers and Stockyards Administration
Federal Grain Inspection Service
P.O. Box 96454
Washington, D.C. 20090-6454

GRAIN INSPECTION HANDBOOK
BOOK I
Probe Sampling
7-07-95

CHAPTER 4

ELLIS CUP AND PELICAN SAMPLING

4.1	ELLIS CUP SAMPLING	4-3
4.2	PELICAN SAMPLING	4-5
4.3	GRAIN QUALITY CHECKS	4-6

PAGE LEFT BLANK INTENTIONALLY

4.1 ELLIS CUP SAMPLING

- a. The Ellis cup is a manual device, constructed of lightweight aluminum, designed to draw a sample from grain moving on a conveyor belt. See the FGIS Equipment Handbook for design specifications.
- b. To obtain a representative sample with an Ellis cup, the sampler must periodically (approximately once each 500 bushels) draw three cupfuls (a set) of grain from the moving stream. The following chart shows the minimum number of sets that must be drawn from each type of carrier:

Carrier	Minimum Number of Sets
Hopper Car	2 sets per compartment
Boxcar	4 sets
Truck	2 sets
Barge/Ship	1 set per 500 bushels

Figure 1. Minimum Number of Sets

- c. When using an Ellis cup, the sample must be drawn at a location in elevator's load-out or load-in system that will ensure its representiveness.
 - (1) Outbound Grain. Draw the sample after the final elevation of the grain and as close as physically practicable to the end of the loading spout.
 - (2) Inbound Grain. Draw the sample before or immediately after the initial elevation of the grain.
- d. Draw sets at random intervals as follows:
 - (1) Face "upstream" and firmly grasp the Ellis cup in both hands.
 - (2) Stand as close to the point where the grain is delivered to the conveyor belt as possible. The area where you stand should be free of loose grain and be well-lighted.
 - (3) To avoid the possible loss of the Ellis cup, fasten one end of a cord to the cup and the other end to a secure object.

CAUTION: Under no circumstances should the Ellis cup be tied to you or another person

- (4) With its open-end facing into the grain flow, insert the heel (curved portion) of the Ellis cup into the center of the grain stream.

- (5) Push the open-end downward through the grain until the bottom of the cup is parallel with the belt.

CAUTION: Avoid catching the cup on the splice that connects the belt ends. The location of the splice can be identified by ripples that usually occur over it in the grain stream

- (6) When the cup is full, move the open-end of the cup upward and remove the cup from the stream. Pour the contents of the cup into a sample collection container.
- (7) Draw two more portions from the stream, one at a point halfway between the center and the right edge of the stream, and the other at a point halfway between the center and the left edge. Pour each cup into the sample collection container.

4.2 PELICAN SAMPLING

- a. Pelican samplers are constructed of a russet, top grade cowhide pouch attached to a metal frame. The back edge of the frame is higher than the front to help catch more grain and direct it into the pouch, even when the pelican is not perfectly vertical in the grain stream. See the FGIS Equipment Handbook for design specifications.
- b. To obtain a representative sample with a pelican, the sampler must periodically (approximately once each 500 bushels) take a pelican (a cut) of grain from the falling stream. The following chart shows the minimum number of cuts required for each type of carrier.

Carrier	Minimum Number of Cuts
Hopper Car	2 cuts per compartment
Boxcar	4 cuts
Truck	2 cuts
Barge/Ship	1 cut per 500 bushels

Figure 2. Minimum Number of Cuts

- c. Take cuts at random intervals as follows:
 - (1) Have the loading spout positioned so that the pelican can be easily swung through the entire falling stream of grain.
 - (2) Check your footing and position yourself close to the spout. Be sure that the area is reasonably clear of grain, debris, and any obstacles.
 - (3) Hold the pelican so that the pouch is next to the falling stream.
 - (4) Grasp the pelican firmly, then swing it completely through the stream of grain in one continuous motion. The direction of the swing is not specified, but it is important to keep the pelican opening facing into the grain stream throughout the swing and to cut the entire stream of grain.
 - (5) Pour the contents of the pelican into a sample collection container.

4.3 GRAIN QUALITY CHECKS ¹

When sampling grain being loaded into or unloaded from a unit train (Cu-sum only), a fleet of lash barges (Cu-sum only), a standard-size (river) barge, or an ocean-going vessel:

- a. Periodically, monitor elevator operations to ensure that the sample being collected represents the lot being loaded/unloaded.
- b. Examine subsamples and component samples for heating, "distinctly low quality" (DLQ), unusual conditions, odor, and infestation. If the lot is being inspected under the Cu-sum plan, also check grading factors. (See figure 1, page 4-6.)

NOTE: If it is not possible to examine subsamples/component samples at the collection site, examine them later at an inspection laboratory

- (1) At least once every 5,000 bushels, remove the grain sample from the collection box or container. This sample is called a subsample.
- (2) Determine if the subsample is heating, DLQ, has any unusual condition, or has a musty, sour, or commercially objectionable foreign odor.

NOTE: Subsamples may also be examined for insects injurious to stored grain. If procedure is used, the total number of insects found in all sub-samples comprising the component shall be used to determine if the component is "infested." For instance, if one weevil is found in the first subsample and one in the second, the component has two weevils and is considered to be "infested." If the subsamples are checked for insects, it isn't necessary to combine subsamples and examine component samples.

- (3) If the subsample is found to be heating, DLQ, have an unusual condition, or have an off-odor, complete a sample ticket that notes the condition found. Then, place the sample--with the sample ticket--in a separate container and notify your supervisor and the elevator manager immediately.
- (4) If the subsample is in sound condition, then it may be combined with the next consecutively-drawn subsample(s) to form a component sample. A component sample represents approximately 10,000 bushels of grain and should be approximately 2,500 grams in size.
- (5) Sieve the component sample and then check the grain on top of the sieve and the material that passed through the sieve for insects. Don't sieve more than 1,000 grams at a time.

* Use an 8/64-inch round-hole sieve for corn and soybeans.

¹ Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See Appendix 1, **Local Quality Control Programs**, for additional information.

- * Use a .064-inch X 3/8-inch oblong-hole sieve for other grains.
 - * With the approval of both the official agency and the local FGIS field office managers, other sieve sizes may be used if needed to optimize particle separation and enhance the examination process.
- (6) If insects are detected, note the kind and number of insects found on a sample ticket. Then, place the sample--with the sample ticket--in a separate container and notify your supervisor and the elevator manager immediately.
- (7) If the component sample doesn't contain any insects injurious to stored grain, then it may be combined with another component sample(s) to form a subplot or lot sample.
- c. Monitor the grain stream, as practical, for foreign material too large to enter the Ellis cup or pelican samplers, such as corn cobs, coal, concrete, stones, wood, paper, glass, lumps, or dead animals. If large foreign material is present in the grain stream, immediately inform your supervisor and the elevator manager. Document your observation on the sample ticket.

NOTE: DO NOT ATTEMPT TO REMOVE OBJECTS FROM THE GRAIN STREAM.

CARRIER(S)	FREQUENCY OF EXAM (Approximate)	FACTOR(S) ANALYZED
Ships/Lash Barges (Cu-sum)	Maximum 5,000 bushels (Subsample)	Odor, heating, DLQ, unusual conditions
	Minimum 10,000 bushels (Component)	Grading factors <u>1</u> / Infestation <u>2</u> /
Unit Trains (Cu-sum)	Individual car basis (Subsample/Component)	Grading factors <u>1</u> / infestation <u>2</u> / DLQ, heating, unusual conditions
Articulated Railcars (Cu-sum)	Individual "unit" basis (Subsample/Component)	
Articulated Railcars (Single-lot)	Individual "unit" basis	Infestation <u>2</u> / odor, heating, DLQ, unusual conditions
Standard Railcars (Single-lot)	Individual car basis	Infestation <u>2</u> / odor, heating, DLQ, unusual conditions
Barges (Single-lot & Cum-sum)	Maximum 5,000 bushels (Subsample)	Odor, heating, DLQ, unusual conditions
	Minimum 10,000 bushels (Component)	Infestation <u>2</u> /
Trucks (Single-lot)	Individual truck basis	Infestation <u>2</u> / Odor, heating, DLQ, unusual conditions

Figure 1. Sample Analysis Intervals

¹ Under the Cu-Sum plan, examine for "more than a two grade difference in grade factor results" (see FGIS [Grain Inspection Handbook](#), Book III, for more information about checking the quality of grain loaded aboard ships, lash barges, and unit trains).

² Tolerances apply to individual trucks, railcars, rail "units," and barge/ship/unit train components. Minimum sampling rate for bargelots/shiplots is 500 grams for each 2000 bushels sampled.

LOCAL QUALITY CONTROL PROCEDURES

1. General

Even though this handbook is designed to be used by all official samplers at all sampling sites, FGIS realizes that some of the requirements and stipulations stated herein may not be appropriate or necessary in all situations. To better address such situations, official agency/FGIS field office managers may develop **local quality control procedures**. These procedures, which must comply with certain general requirements (see below), may be used in conjunction with, or in place of, the procedures established by Book I.

2. Responsibilities

- a. Local quality control procedures may be developed by official agency managers and/or FGIS field office managers.
- b. Local quality control procedures must be reviewed and approved by both the official agency manager (when applicable) and the local FGIS field office manager prior to being implemented.

3. Approval Criteria

Local quality control procedures must:

- a. Be reasonable; i.e., proper for the situation, cost-effective, and practical.
- b. Comply with applicable provisions of the USGSA and the regulations thereunder.
- c. Comply with all FGIS and OSHA safety requirements.
- d. Have the consent of elevator management if elevator operations are affected; e.g., the D/T sampler must be shut-down every 4 hours.
- e. Not compromise the integrity/representativeness of the official sample.
- f. Be nondiscriminatory.

4. Request for Approval

- * a. All requests for approval of local quality control procedures must be submitted,
* in writing, to the local FGIS field office manager for final approval.
- * b. The approved request shall be signed and dated by both the official agency
* manager (when applicable) and the local FGIS field office manager
- * (1) A copy of the request and quality control plan shall be placed on file at the
* official agency's main office (when applicable) and at the local FGIS field
* office. They shall remain on file until such time as the procedures are
* changed or rescinded.
- * (2) A copy of the quality control plan shall be available at the service
* point/sampling site.

(Revised 11-17-95)